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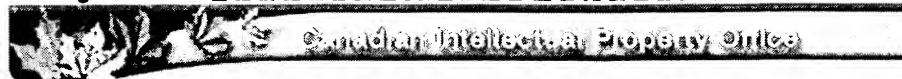
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## Canadian Patents Database

(12) Patent:

(11) CA 611101

(54) JIGS

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ABSTRACT:

CLAIMS: [Show all claims](#)

\*\*\* Note: Data on abstracts and claims is shown in the official language in which it was submitted.

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[Important Notices](#)

This invention relates to a jig for the location of two or more tubular sections of circular cross-section in coaxial end-to-end relationship. The jig is suitable for holding the tubular members in end-to-end coaxial relationship while the members are being welded together.

The jig of the invention is particularly applicable to the location of sections of a stator blade casing for a gas turbine engine while the sections are being welded together.

Heretofore it has been proposed, for example in U.S. Patent No. 1,878,725, of Stovall, to provide a jig having shoes which move radially outwardly under the influence of the relative movement of complementary conical bearing surfaces, the shoes engaging inner surfaces of tubular parts to be centred and holding them during welding. Each shoe was a sector of a circle and was of fixed radius and therefore of fixed curvature. It will be appreciated that with such shoes there will only be one position in which the outer surfaces of the shoes will lie upon a true circle. It follows that, to completely support the tubular members, the shoes would have to be of such a radius that in their expanded position their outer surfaces lay on a true circle which was identical to the internal cross-section of the tubes to be welded.

However, such an arrangement makes no allowance for manufacturing tolerances in the components to be welded and if these were slightly larger in diameter than the circle of the shoes but were, nevertheless, within allowable tolerances, such an arrangement would not effectively centre them and support them during welding because if the shoes are expanded further they will cease to be a true circle and will only support the components at spaced apart zones around the periphery since the curvature of the outer periphery of the shoes will no longer conform with the inner periphery of the sections to be welded.

Conversely, if the sections are slightly smaller in diameter than the expanded diameter of the shoes of the jig but are, nevertheless, within the allowable tolerances, the shoes will not support the sections throughout their whole periphery since the curvature of the outer periphery of the shoes will not mate with the curvature of the inner peripheries of the sections.

It is extremely important in such welding jigs that the inner peripheries of the tubular members being welded are supported substantially throughout their periphery. One reason why it is important is that with surface contact around the whole periphery the heat applied to the members being welded is quickly dissipated into the jig. A second reason is that as the weld cools it shrinks but if the inner periphery of the weld is held around substantially its whole periphery then the weld will be held smooth and concentric and there will be no distortion. If the weld is not fully supported, then distortion will occur during cooling.

It will be seen that full support of the inner peripheries of the parts to be welded cannot be obtained with shoes of fixed curvature as proposed in the prior art over a given band of tolerances since the curvature of the shoes cannot change and there will be only one position and therefore one diameter in which full support can be given.

The object of the invention is to provide a jig that will hold two or more tubular sections of circular cross-section in coaxial end-to-end relation and will internally support substantially the whole periphery of each of the sections over a given range of tolerances, the diameter of the supporting parts being adjustable within working limits to the diameters of the sections.

A further object of the invention is to provide a jig which will hold two or more tubular sections of circular cross-section in coaxial end-to-end relation and which may be

ably assembled and dismantled as the assembly proceeds and after it is finished.

The invention will now be described by way of example with reference to the accompanying drawings, in which like reference numerals indicate similar parts throughout the various views, and in which:

Figure 1 is a perspective view, partly cut away, of a jig according to the invention having the sections of a stator blade casing located on the jig;

Figure 2 is a detail horizontal section through the jig assembly of Figure 1 except that the parts are shown in an initial position whereas in Figure 1 the parts are shown in a final, centred position;

Figure 3 is a transverse section on the line 3-3 of Figure 2;

Figure 4 is a section on the line 4-4 of Figure 1 and is similar to Figure 2 but shows the segmented ring expanded to centre the tubular sections; and

Figure 5 is a transverse section on the lines 5-5 of Figure 4;

Referring now to the drawings, the stator casing is indicated generally at 10 and consists of seven sections which, in the finished casing, are welded together. The sections which make up the casing are a flanged ring 11 at one end of the casing, a first tapering tubular section 12, a first intermediate ring member 13, a second tapering tubular section 14, a second intermediate ring member 15, a third tapering tubular section 16 and finally a flanged ring 17. As will be seen from the drawing, the stator casing tapers from the flanged ring 11 towards the flanged ring 17.

The jig itself consists of an annular base plate 18 having an upstanding annular rib 19. Resting on the base plate 18 and confined by the annular rib 19 is a support plate 20 to which is welded an upstanding tube 21, the tube

ing sufficiently long to run from one end of the stator casing to the other.

Welded to the tube 21 is a series of eight radially projecting webs 22, each formed with three steps on its outer edge as indicated at 23, 24 and 25 for the web which is in full view in Figure 1. A cylindrical support ring 26 rests on the steps 23 and is welded thereto. Similarly, a cylindrical support ring 27 rests on the steps 24 and is welded thereto; a cylindrical support ring 28 rests on the steps 25 and is welded thereto.

The flanged ring 17 has an annular rib 29 depending from its lower surface; the rib 29 closely surrounds the edge of the support plate 20 and locates the ring 17 on the support plate. A support ring 30 rests on the support plate 20 and the upper surface of the support ring is rabbetted at 31. The ring 30 is secured by bolts 32 to the support plate 20 and the base 18, the bolts serving to connect together the ring 30, the support plate 20 and the base 18. The bolts are counter-sunk so that their heads are below the level of the horizontal ledge produced by the rabbetting 31.

Resting on the support ring 30 is a segmented ring generally indicated at 33 and consisting of segments 33a. The inner periphery of the ring has a conical bearing surface 34. The outer periphery of the ring has a peripheral groove 35 for a purpose hereinafter to be described.

Moreover, each segment 33a of the ring 33 is provided at its inner periphery with a series of radially extending slots 33b. The provision of the slots renders the segments flexible and the depths of the slots and their frequency are chosen so that the rings are more flexible than the tubular sections which they are to centre whereby, as the ring is expanded, the segments are able to deform so that their outer surfaces always lie on a true circle concentric with the jig.

Inserted between the segments 33a of the ring and the wall of the rabbet 31 is a substantially rigid annulus 36. The annulus has an outer peripheral bearing surface 37 which is conical and which is complementary to the conical surfaces 34 on the segments 33a of the ring. The annulus is secured to the support ring 30 by a plurality of circumferentially spaced bolts 38.

It will be seen that, if the bolts 38 are tightened down, the annulus 36 will be moved downwardly and the conical surfaces 34 and 37 will move relatively to one another thus forcing the segments of the segmented ring 33 radially outwardly. The outer periphery of the segmented ring is in contact with the inner peripheral surfaces of the third tapered tubular portion 16 and also of the flanged ring 17. As the segmented ring moves outwardly it engages the inner peripheral walls of the portions 16 and 17 to centre them and locate them relatively to one another. The outer peripheral wall of the segmented ring is tapered slightly to conform with the taper of the stator casing as a whole.

The peripheral groove 35 lies opposite to the joint between the tubular portion 16 and the flanged ring 17 so that when the portions are being welded together any weld bead which may be formed will be accommodated within groove 35.

Resting on the support ring 26 is an annular support plate 39 which has a rabbetted edge 40. Resting on the rabbetted edge 40 is a segmented ring 41, each of the segments of which has a plurality of radial cuts in its inner peripheries in order to make it flexible. The outer periphery of the segmented ring 41 is provided with a peripheral groove 42 to serve a similar purpose as the groove 35. The inner periphery of the segmented ring has a conical bearing surface 43. Interposed between the segmented ring 41 and the wall 44 of the rabbet of the support plate 39 is a substantially rigid annulus 45. The outer periphery of the annulus has a conical

aring surface 46 which is complementary to the conical bearing surface 43 on the segmented ring. The annulus 45 is secured to the support plate 39 by bolts 47 which are threaded into the rabbetted edge of the support plate 39. The outer periphery of the segmented ring 41 is in contact with the abutting edges of the third tubular section 16 and the second intermediate ring 15. The outer periphery of the ring is tapered to conform to the general taper of the stator casing. It will be appreciated that as the bolts 47 are tightened down the annulus 45 will be caused to move downwardly whereby the conical bearing surfaces 43 and 46 will move relatively to one another, the segments of the segmented ring 43 moving outwardly and being deformed to centre and locate the sections 15 and 16.

Resting on the support plate 39 is a further support plate 48 having a depending annulus 49 which rests on top of the plate 39. The plate 48 has a rabbetted edge 50 on which rests a segmented ring 51, each of the segments 51a of which has a plurality of radial cuts 51b in its inner peripheries in order to make it flexible. The outer periphery of the segmented ring 51 is in contact with the abutting edges of the tubular section 14 and the intermediate ring 15, and has a peripheral groove 52 to accommodate any weld bead formed while welding the sections 14 and 15 together. Interposed between the segmented ring 51 and the wall 53 of the rabbetted edge of the support plate 48 is a substantially rigid annulus 54. The outer periphery of the annulus has a conical bearing surface 55 which is complementary to a conical bearing surface 56 on the inner periphery of the segmented ring 51. The annulus is secured to the support plate 48 by bolts 57; and it will be appreciated that by tightened down the bolts 57 the annulus 54 will be caused to move downwardly thus causing relative movement between the conical bearing surfaces 55 and 56 and moving the segments of the segmented ring 51 outwardly to deform and to locate and centre the sections 14 and 15.

The support plates 39 and 48 are secured to the support ring 26 by a series of bolts 58 which pass through the support plate 48 and through the support plate 39 before entering the support ring 26. Holes 59 are provided in the support plate 48 to permit the insertion of a wrench to adjust the bolts 47 as will hereinafter be described.

Resting on the support ring 27 is an assembly similar to the assembly described as resting on the support ring 26. A support plate 60 has a rabbetted edge 61 on which is received a segmented ring 62, each of the segments 62a of which has a plurality of radial cuts 62b in its inner periphery in order to make it flexible. The inner periphery of the segmented ring has a conical bearing surface 63 and interposed between the segmented ring and the wall of the rabbetted edge is a substantially rigid annulus 64 whose outer periphery has a conical bearing surface 65. The outer periphery of the segmented ring 62 is provided with a peripheral groove 66 and the annulus is secured to the support plate 60 by bolts 67. The operation of this assembly is similar to the operation of the assemblies previously described.

Resting on the support plate 60 is a further support plate 68 having a depending annulus 69. The support plate 68 has a rabbetted edge 70 on which is received a segmented ring 71 having an inner peripheral conical bearing surface 72. Each of the segments 71a of the ring 71 has a plurality of radial cuts 72b in its inner periphery to make it flexible. The segmented ring has an outer peripheral groove 73. Interposed between the segmented ring 71 and the wall of the rabbetted edge is a substantially rigid annulus 74 having a conical bearing surface 75. The annulus is secured to the support plate 68 by bolts 76. Holes 77 are provided in the support plate 68 to permit operation of the bolts 67 as will hereinafter be described. The support plates 60 and 68 are secured

Resting on the support ring 28 is a support plate 79 having a rabbetted edge 80. Resting on the rabbetted edge is a segmented ring 81 having an outer peripheral groove 82 and an inner peripheral conical bearing surface 83. Each of the segments 81a of the ring 81 has a plurality of radial cuts 72b in its inner periphery to make it flexible. Interposed between the segmented ring 82 and the wall of the rabbet of the support plate 79 is a substantially rigid annulus 84 having a conical bearing surface 85. The annulus 84 is secured to the rabbetted edge of the support plate 79 by bolts 86. The support plate 79 is secured to the support ring 28 by bolts 87. An annular top plate 88 is secured to the support plate 79 by bolts 89. The top plate has a depending rib 90 which embraces an upstanding rib on the flanged ring 11 and locates the ring.

In operation, the jig and stator casing are assembled step by step. Thus the assembly is started with both the jig and the stator casing in their component parts. The base plate 18 is first laid on a bench and the support plate 20, together with its attached tube 21, radial webs 22 and support rings 26, 27 and 28, are mounted on the base plate. The support ring 30 is then placed in position and is secured by the bolts 32, the bolts also serving to secure together the support plate 20 and the base plate 18. The ring 17 is then placed over the top of the jig and is brought down so that its depending rib 29 is surrounding the edge of the plate 20. The third tubular section 16 is then placed over the top of the jig so that it is resting on top of the flanged ring 17. The segments of the segmented ring 33 are then placed in position on the support ring 30 and the annulus 36 is interposed between the wall of the rabbet on the ring 31 and the segmented ring. The bolts 38 are placed in position and the annulus is tightened down.

As the bolts 38 are tightened down, the segments of the segmented ring 33 are moved radially outwardly and the tightening is continued until the segments of the ring engage

the inner peripheral portions of both the flanged ring 17 and the tubular section 16 and centre them.

Referring now to Figures 2 and 3, the parts are there shown in their initial positions after assembly and before the parts have been centered by moving the annulus 36. It will be seen that the flanged ring 17 is somewhat larger in diameter than the tubular section 16, and in order to be able to weld the components successfully together it is necessary that they be aligned and centered. The bolts 38 are therefore tightened down to move the annulus 36 downwardly thus forcing outwardly the segments 33a of the segmented ring 33. The annulus 36 is moved downwardly until the parts 16 and 17 are in alignment and are centered as shown in Figures 4 and 5. It will be appreciated that during this outward movement each of the segments 33a will deform. Since the segments are more flexible than the components 16 and 17, as described above, and since the annulus 36 is substantially rigid, the segments will always be kept in complete contact with the annulus 36 whereby the outer periphery of the segments will, since the outer periphery of the annulus may be considered as made up of an infinite number of circles of different diameters, always lie upon a true circle. This is clearly shown with reference to Figures 4 and 5.

It follows that when the sections 16 and 17 have been brought into alignment by movement of the annulus 36 they will be concentric with the jig, their peripheries will be truly circular and will be supported throughout their length. Due to this complete support the heat applied to the casing during welding will be quickly dissipated to the jig and, after welding, the complete support will prevent the sections distorting during cooling.

When the sections 16 and 17 have been located relatively to one another, the support plate 39 is placed over the top of the jig and is brought to rest on the support ring

16 and the intermediate ring 15 is placed over the top of the jig and brought down so that it abuts against the top of the section 16. The segments of the segmented ring 41 are then placed on the rabbetted edge of the support plate 39, the annulus 45 is inserted between the segments of the segmented ring and the wall of the rabbet, and the bolts 47 are loosely entered to keep the annulus in place. The bolts are not yet tightened down to force the segments against the inner peripheries of the sections 15 and 16.

The support plate 48 is then placed over the top of the jig and is brought down until it rests on top of the support plate 39. The bolts 58 are then inserted to secure the support plates 48 and 39 to the support ring 26. When the bolts 58 have been tightened down and the assembly is rigid, a wrench is inserted through the holes 59 in turn and the bolts 47 are tightened down to move the annulus 45 downwardly. As the annulus 45 moves downwardly the conical bearing surfaces 43 and 46 are moved relatively to one another and the segments of the segmented ring 41 move outwardly and are deformed to engage and centre the section 16 and the intermediate ring.

When this operation has been completed, the tubular section 14 is placed over the top of the jig and brought down to abut against the intermediate ring 15. The segments 51a of the segmented ring 51 are placed on the rabbetted edge of the support plate 48 and the annulus 54 is inserted between the segmented ring and the wall 53 of the rabbet. The bolts 57 are then entered and tightened down to centre the sections 14 and 15.

The support plate 60 is then placed over the top of the tube and is brought down to rest on top of the support ring 27. The first intermediate ring 13 is then placed over the top of the jig and is brought down until it abuts against the end of the tubular section 14. The segments 62a of the ring 62 are placed upon the rabbetted edge 61 and the annulus 64 is inserted

between the segments of the segmented ring and the wall of the rabbet. The bolts 67 are inserted loosely to keep the annulus in place but are not yet tightened down. The support plate 68 is then placed over the top of the jig and brought down until it rests upon the top of the support plate 60. The bolts 78 are then entered and tightened down to secure together the support plate 68, the support plate 60 and the support ring 27. When the assembly has thus been rigidly connected, a wrench may be inserted through the holes 77 in turn and the bolts 67 may be tightened down to move the segments 62a of the segmented ring 62 radially outwardly to centre the tubular section 14 and the first intermediate ring 13.

When this operation has been completed the section 12 is placed over the top of the jig and brought down to abut against the ring 13. The segments 71a of the segmented ring 71 are placed upon the rabbetted edge 69 of the support plate 67 and the annulus 74 is inserted between the segmented ring and the wall of the rabbet. The bolts 75 are then entered and tightened down to centre the sections 12 and 13.

The support plate 79 is then placed over the top of the jig and is secured in place by the bolts 87. The flanged ring 11 is placed over the top of the jig so that it abuts the top of the first tubular section 12. The segments of the segmented ring 81 are then placed upon the rabbetted edge 80 of the support plate 79, and the annulus 84 is placed in position. The bolts 86 are entered and tightened down so that the segments of the segmented ring 81 are moved radially outwardly to centre and locate the flanged ring 11 and the first tubular section 12. Finally the top plate 88 is placed in position and is tightened down by the bolts 89 thereby holding the whole assembly together lengthwise.

It will be appreciated that as each segmented ring is expanded to centre its corresponding sections, the segments of the ring will deform in a manner similar to that described for the segments 33a so that the sections, when in alignment, will be concentric with the jig, truly circular and supported throughout their peripheries.

The joints between the various sections are now effected by welding and any weld bead which is formed is accommodated by the peripheral grooves in the segmented rings.

After the stator casing has been assembled, the jig may be disassembled in the reverse order from that in which it was assembled. That is to say, the top plate 88 is first removed and then the support plates are removed beginning from the top and working downwards thus resolving the jig into its component parts.

Instead of providing each segment with radial slots, the segments may be made of inherently flexible material, the material being chosen with a particular application in view so that the material is more flexible than the sections to be centred. However, due to the probability of such flexible material becoming work hardened after considerable use it is normally desired to provide the segments with radial slots as hereinbefore described.

It will be seen that the invention provides a jig in which a plurality of sections may be assembled and, notwithstanding manufacturing tolerances in the sections, centred so as to be truly circular and concentric with the jig. Moreover, the sections are fully supported around their peripheries adjacent to the weld whereby welding heat is dissipated, which is very important when sheet metal is being welded, and whereby the weld is supported during cooling and shrinkage and distortion substantially eliminated.

It will also be seen that the invention provides a jig which is simple in construction and in assembly and which may readily be used to locate a plurality of tubular sections of circular cross-section in coaxial end-to-end relation.

It will be understood that the form of the invention herewith shown and described is a preferred example and various modifications can be carried out without departing from the spirit of the invention or the scope of the appended claims.

THE EMBODIMENTS OF THE INVENTION IN WHICH AN EXCLUSIVE PROPERTY OR PRIVILEGE IS CLAIMED ARE DEFINED AS FOLLOWS:-

1. A jig for the location of a pair of tubular sections of circular cross-section in coaxial end-to-end relation, the jig comprising circular support means about which the sections are to be placed end-to-end, a substantially rigid, conical, peripheral bearing surface of the support means, a segmented ring carried by the support means, the outer periphery of the ring being in a position to engage the inner peripheral surfaces of the adjacent ends of both of the tubular sections, the segments of the ring being more flexible in radial directions than the sections whereby, under outwardly directed radial loads, the ring may be caused to engage substantially the whole periphery of each of said inner peripheral surfaces, a conical bearing surface on the inner periphery of the ring complementary to the conical bearing surface of the support means, and means to move the conical bearing surfaces relatively to one another in a direction to cause the segments of the ring to move radially outwardly to engage substantially the whole periphery of each of said inner peripheral surfaces thus to centre the tubular sections.

2. A jig for the location of a pair of tubular sections of circular cross-section in coaxial end-to-end relation, the jig comprising a circular support plate having an annular abutment surface adjacent to its periphery about which the sections are to be placed end-to-end, a segmented ring carried by the plate adjacent to its periphery and outwardly of the abutment surface, the ring having a conical inner peripheral bearing surface, the outer periphery of the ring being in a position to engage the inner peripheral surfaces of the adjacent ends of both of the tubular sections, the segments of the

ring being more flexible in radial directions than the sections whereby, under outwardly directed radial loads, the ring may be caused to engage substantially the whole periphery of each of said inner peripheral surfaces, a substantially rigid annulus mounted on the plate between the ring and the abutment surface, the outer periphery of the annulus having a conical bearing surface complementary to the conical bearing surface of the ring, and means to move the conical bearing surfaces relatively to one another in a direction to cause the segments of the ring to move radially outwardly to engage substantially the whole periphery of each of said inner peripheral surfaces thus to centre the tubular sections.

3. A jig according to Claim 2, in which the means to move the conical bearing surfaces relatively to one another comprises a plurality of screw threaded bolts passing through the annulus and being received in threaded holes in the plate.

4. A jig for the location of a pair of tubular sections of circular cross-section in coaxial end-to-end relation, the jig comprising a circular plate about which the sections are to be placed end-to-end, the plate having a rabbetted peripheral edge, a segmented ring carried in the rabbet around the edge of the plate, the outer periphery of the ring being in a position to engage the inner peripheral surfaces of the adjacent ends of both of the tubular sections, the segments of the ring being more flexible in radial directions than the sections whereby, under outwardly directed radial loads, the ring may be caused to engage substantially the whole periphery of each of said inner peripheral surfaces, a conical bearing surface on the inner periphery of the segmented ring, a substantially rigid annulus interposed between the wall of the

rabbit and the segmented ring, the outer periphery of the annulus having a conical bearing surface complementary to the conical bearing surface on the segmented ring, and means to move the conical bearing surfaces relatively to one another in a direction to cause the segments of the ring to move radially outwardly to engage substantially the whole periphery of each of said inner peripheral surfaces thus to centre the tubular sections.

5. A jig for the location of a series of tubular sections of circular cross-section in coaxial end-to-end relation, the jig comprising a central pillar around which the sections are to be placed end-to-end, a plurality of circular support means surrounding and carried by the pillar, the support means being spaced apart along the length of the pillar, a substantially rigid conical peripheral bearing surface of each support means, a segmented ring carried by each support means, the outer periphery of each ring being in a position to engage the inner peripheral surfaces of both of the abutting ends of an adjacent two of the tubular sections, the segments of each ring being more flexible in radial directions than the sections whereby, under outwardly directed radial loads, each ring may be caused to engage substantially the whole periphery of each of said inner peripheral surfaces of an adjacent two of the sections, a conical bearing surface on the inner periphery of each ring complementary to the conical bearing surface of its associated support means, each two complementary conical bearing surfaces constituting a pair, and means to move the complementary conical surfaces of each pair relatively to one another in a direction to cause the segments of a ring to move radially outwardly to engage substantially the whole

periphery of each of said inner peripheral surfaces of an adjacent two of the tubular sections thus to centre the sections.

6. A jig for the location of a series of tubular sections of circular cross-section in coaxial end-to-end relation, the jig comprising a central pillar around which the sections are to be placed end-to-end, a plurality of annular support plates surrounding and carried by the pillar, the plates being spaced apart along the length of the pillar and each plate having an annular abutment surface adjacent to its periphery, a segmented ring carried by each support plate adjacent to the periphery thereof and outwardly of the abutment surface, the inner peripheral surface of each ring having a conical bearing surface, the outer periphery of each ring being in a position to engage the inner peripheral surfaces of both of the abutting ends of an adjacent two of the tubular sections, the segments of each ring being more flexible in radial directions than the sections whereby, under outwardly directed radial loads, each ring may be caused to engage substantially the whole periphery of each of said inner peripheral surfaces of an adjacent two of the sections, a substantially rigid annulus mounted on each plate between the abutment surface and the ring carried by the plate, the outer periphery of each annulus having a conical bearing surface complementary to the conical bearing surface of an associated ring, each two complementary conical bearing surfaces constituting a pair, and means to move the complementary conical bearing surfaces of each pair relatively to one another in a direction to cause the segments of a ring to move radially outwardly to engage substantially the whole periphery of each of said inner

peripheral surfaces of an adjacent two of the tubular sections thus to centre the sections.

7. A jig for the location of a series of tubular sections of circular cross-section in coaxial end-to-end relation, the jig comprising a central pillar around which the sections are to be placed end-to-end, a plurality of annular support plates surrounding and carried by the pillar, the plates being spaced apart along the length of the pillar, each of said support plates having a rabbetted peripheral edge, a segmented ring carried in the rabbet around the edge of each support plate, the outer periphery of each ring being in a position to engage the inner peripheral surfaces of both of the abutting ends of an adjacent two of the tubular sections, a conical bearing surface on the inner periphery of each segmented ring, the segments of each ring being more flexible in radial directions than the sections whereby, under outwardly directed radial loads, each ring may be caused to engage substantially the whole periphery of each of said inner peripheral surfaces of an adjacent two of the sections, a substantially rigid annulus inserted between each segmented ring and the wall of the rabbet of its associated support plate, the outer periphery of the annulus having a conical bearing surface complementary to the conical bearing surface of the associated segmented ring, each two complementary conical bearing surfaces constituting a pair, and means to move each annulus relatively to its associated support plate to move the segments of a ring radially outwardly to engage substantially the whole periphery of each of said inner peripheral surfaces of an adjacent two of the tubular sections thus to centre the sections.

8. A jig for the location of a series of tubular sections of circular cross-section in coaxial end-to-end relation, the jig comprising a central pillar around which the sections are to be placed end-to-end, a plurality of webs projecting radially from said pillar, each web having a plurality of steps spaced apart along its length, support rings secured to the steps, annular support plates secured to the support rings, a substantially rigid conical peripheral bearing surface of each support plate, a segmented ring carried by each support plate, the outer periphery of each ring being in a position to engage the inner peripheral surfaces of both of the abutting ends of an adjacent two of the tubular sections, the segments of each ring being more flexible in radial directions than the sections whereby, under outwardly directed radial loads, each ring may be caused to engage substantially the whole periphery of each of said inner peripheral surfaces of an adjacent two of the sections, a conical bearing surface on the inner periphery of each segmented ring complementary to the conical bearing surface of its associated support plate, each two complementary conical bearing surfaces constituting a pair, and means to move the complementary conical bearing surfaces of each pair relatively to one another in a direction to cause the segments of a ring to move radially outwardly to engage substantially the whole periphery of each of said inner peripheral surfaces of an adjacent two of the tubular sections thus to centre the sections.

9. A jig for the location of a series of tubular sections of circular cross-section in coaxial end-to-end relation, the jig comprising a central pillar around which the sections are to be placed end-to-end, a plurality of webs projecting

radially from said pillar, each web having a plurality of steps spaced apart along its length, support rings secured to the steps, annular support plates secured to the support rings, each of said support plates having a rabbetted peripheral edge, a segmented ring carried in the rabbet around the edge of each support plate, the outer periphery of each ring being in a position to engage the inner peripheral surfaces of both of the abutting ends of an adjacent two of the tubular sections, a conical bearing surface on the inner periphery of each segmented ring, the segments of each ring being more flexible in radial directions than the sections whereby, under outwardly directed radial loads, each ring may be caused to engage substantially the whole periphery of each of said inner peripheral surfaces of an adjacent two of the sections, a substantially rigid annulus inserted between each segmented ring and the wall of the rabbet of its associated support plate, the outer periphery of each annulus having a conical bearing surface complementary to the conical bearing surface of its associated segmented ring and means to move each annulus relatively to its associated support plate to move the segments of a ring radially outwardly to engage substantially the whole periphery of each of said inner peripheral surfaces of an adjacent two of the tubular sections thus to centre the sections.

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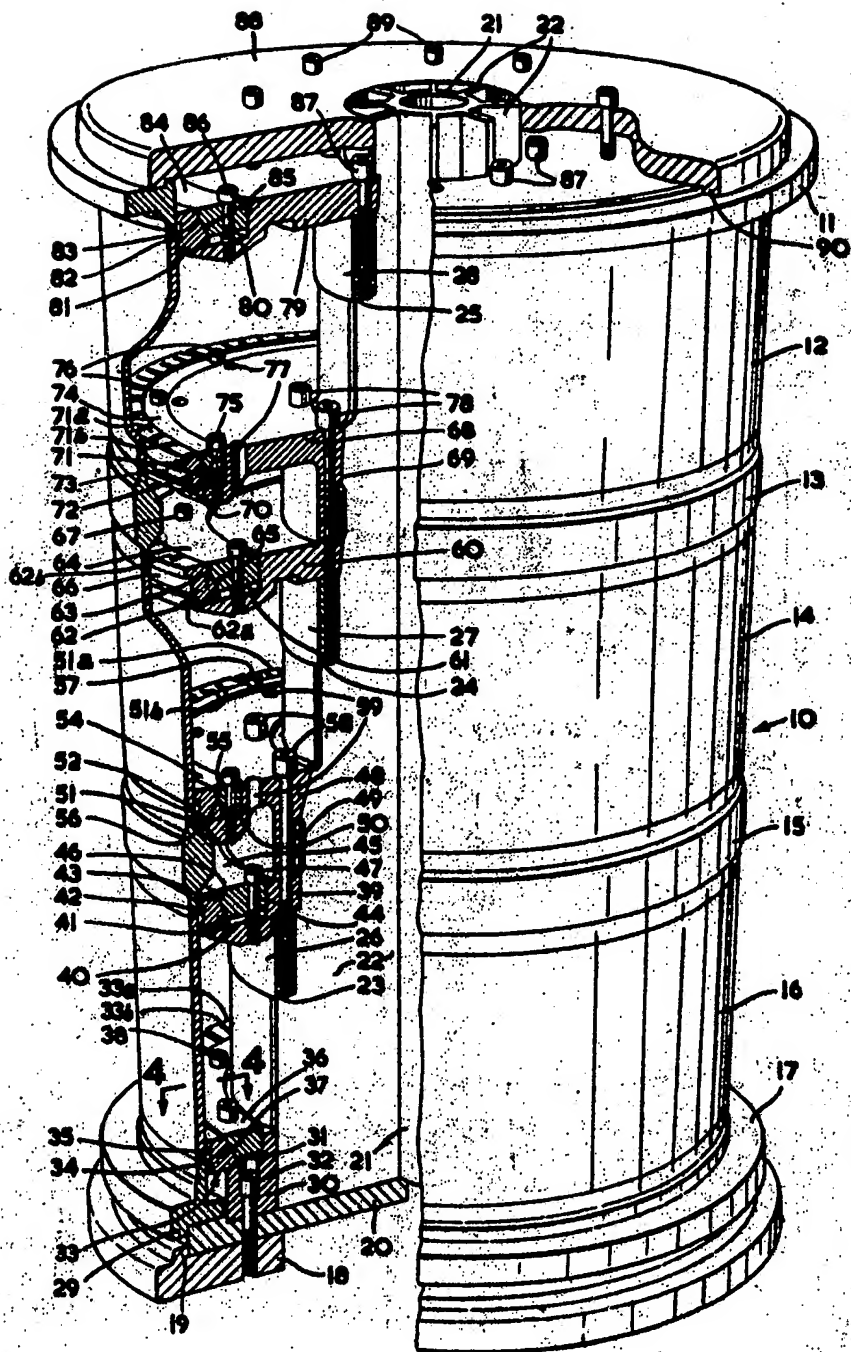


FIG. 1

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PATENT AGENT

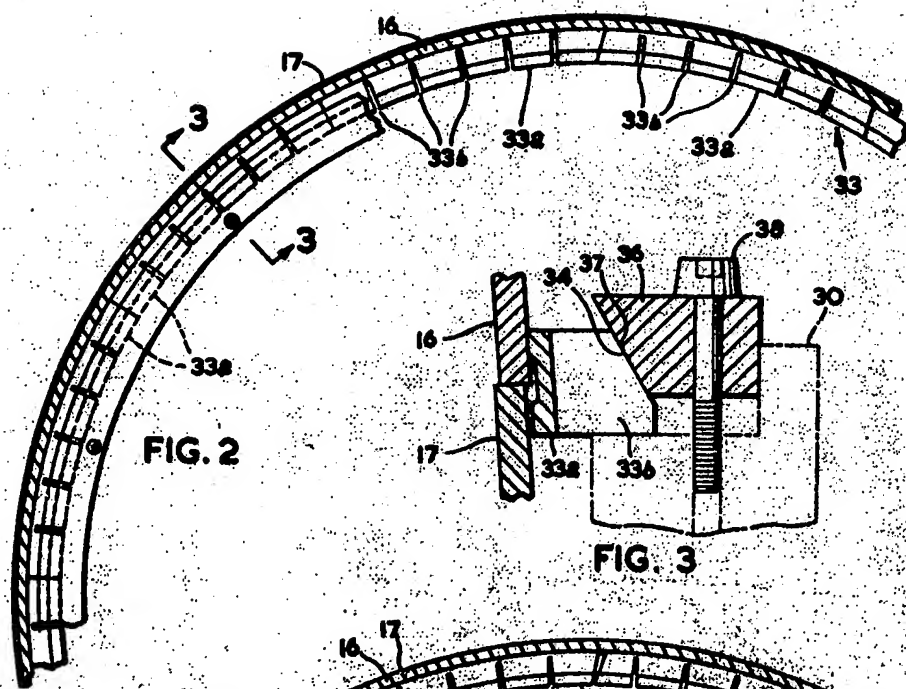


FIG. 2

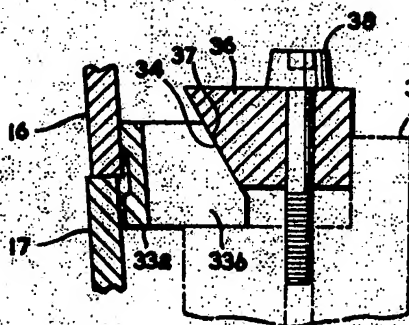


FIG. 3

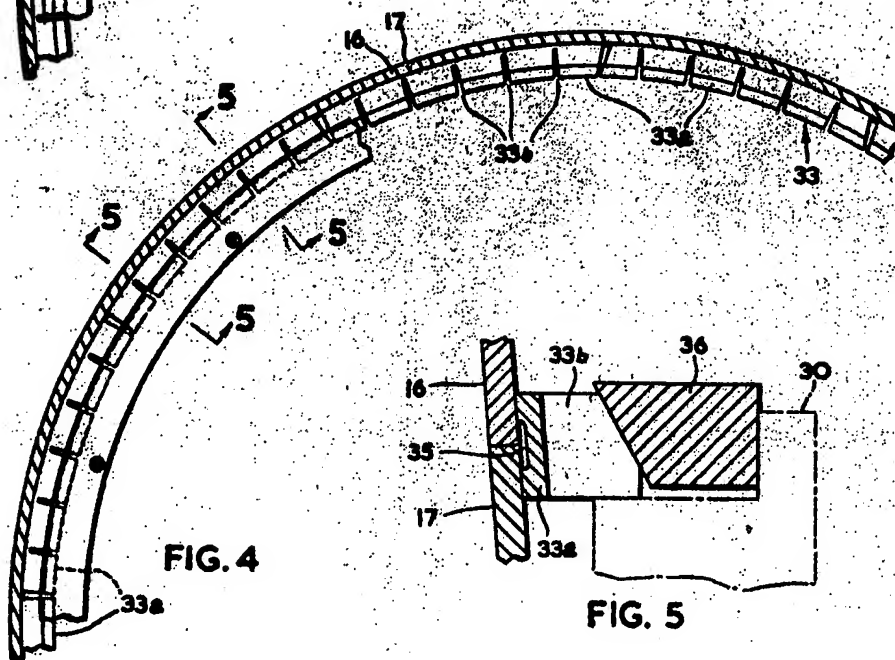


FIG. 4

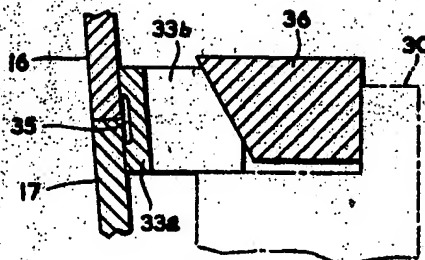


FIG. 5

INVENTOR  
A. J. ALLAN  
V. POPPA

PATENT AGENT

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